stricted. Outside of England, Germany, and France, very few formations have been seriously studied; almost the only successful explorations have been in railway-cuttings. One indication of what may be discovered elsewhere is furnished by the remarkable petrifactions which have resulted from some researches prosecuted in Africa and Asia, in the neighbourhood of the Cape, and on the Himalayas: forms have been discovered which fill up important gaps in palæontological classification. It must be remembered also that only the hard and solid parts of organisms have been preserved, that entire forms, such as the Medusæ, shell-less molluscs, many articulata, nearly all worms, could leave no trace behind. The most important parts of plants, the flowers, have completely disappeared. Moreover, terrestrial organisms have been petrified only in accidental instances, where they have fallen into the water and been covered with mud; it is not to be wondered at then if the number of fossils of this kind is relatively much less considerable than that of those kinds which have inhabited the sea or fresh water. This explains also the apparently strange fact that of many fossil mammals, especially those of the secondary, we recognise only the lower jaw. This arises from the fact that that bone is easily separated from the dead body; while the rest swims on the surface of the water and is carried to the bank, the jaw falls to the bottom, and is buried in the mud, where it is petrified. The traces of those which have been found in different beds of sandstone, and especially in the red sandstone of Connecticut, belong to organisms whose bodies are entirely unknown to us, and prove that we are far from possessing remains of all actual forms. What gives us reason to think that an immense number must remain unknown is the fact that of those whose fossil remains we possess, only one or two examples have come to light. It is only ten years since a bird of the highest importance was discovered in the Jura; till then no intermediate form was known between the birds proper and reptiles, which are, nevertheless, the class most closely related to the former. Now this fossil bird, which possesses the tail, not of an ordinary bird, but of a lizard, confirms the hypothesis that birds are descended from the saurians. A couple of small teeth which have been found in the Keuper of the Trias are, up to the present, the only proof that mammals have existed from the Triassic period, and that they did not appear only in the Jurassic period, as was previously believed.

Fortunately we are able to supplement the insufficient data of palæontology by those of embryology, since individual development is, as it were, a reproduction or recapitulation brief and rapid, by means of heredity and adaptation of the development of species. Embryology is especially valuable for the light which it throws on the more ancient forms of the primordial period; by it alone do we learn that these primitive forms must have been simple cells, similar to eggs; that these cells, by their segmentation, their conformation, and their division of labour, have given birth to the infinite variety of the most complicated organisms.

To the valuable data respecting the relations of organisms furnished by palæontology and embryology must be added those derived from comparative anatomy. When organisms, whose exterior is very different, resemble each other in their interior construction, we may conclude with certainty that this resemblance is due to heredity, while the differences are a result of adaptation. If, for example, we compare the limbs or extremities of different mammifers, the arm of man, the wing of the bat, the anterior members of the mole adapted for digging, those of other mammifers made for leaping, climbing, or running; if we consider, besides, that in all these members variously formed, the same bones are found, equal in number, in the same place, disposed in the same manner, are we not forced to admit the close relationship of organisms? This homology can be explained only by heredity, by descent from common ancestors. And to go still further, if we find in the wing of the bird, in the anterior members of reptiles and amphibia, the same bones as in the arms of man, or in the anterior limbs of other mammifers, can we not affirm with certainty the common descent of all these vertebrate animals?

SCIENTIFIC SERIALS

Ocean Highways, May.—The first paper in this number is an article on Mexico, by Mr. Maurice Kingsley, accompanied by a map showing the course of the Vera Cruz and Mexico Railway. This is followed by a very interesting article on "Railway Communication between London and Calcutta," with a map showing the proposed line from Ostende, by Vienna, Constantinople, Diabeker, Herat, Cabul, Lahore, Delhi, Cawnpore, and Calcutta. By this route the land journey would amount to 6,336 miles, with only 73 miles of sea, which could be accomplished in 214 hours, or about 9 days; while by the present shortest route, the sea-journey amounts to 3,941 miles, and the time taken is 492 hours, or upwards of 20 days. Dr. Robert Brown contributes a paper entitled "A Cruise with the Whalers in Baffin's Bay," which is followed by "Notes on Mr. Stanley's Work," by Capt. R. F. Burton, in which that gentleman points out several things in Stanley's book that he thinks are capable of amendment. Burton thinks Stanley "wants only study and discipline, to make him a first-rate traveller." This is followed by a very valuable paper on "The Steppes to the North of Bokhara," by A. Vámbéry. Then follow the usual reviews, notes, reports of societies, &c.

SOCIETIES AND ACADEMIES

LONDON

Chemical Society, May 1.—Dr. Odling, F.R.S., president, in the chair.—Dr. H. Sprengel, "On a new class of explosives," gave an account of some new explosives consisting of two liquids inexplosive by themselves, but which when mixed and fired with a detonating charge are as effective as nitroglycerine.—Prof. Abel of the Royal Arsenal, Woolwich, drew attention to the great difference produced by variations in the mechanical state of the explosive.—On Zirconia, by Mr. J. B. Hannay.—On Pyrogallate of lead and lead salts, by Mr. W. H. Deering.

Royal Horticultural Society, April 16.—General meeting, Sir Coutts Lindsay, Bart., in the chair. The Rev. M. J. Berkeley commented on the plants exhibited, and remarked that the unused archways of railways might be profitably employed for the production of mushrooms.—Mr. W. A. Lindsay (the secretary) enumerated the concessions which the Council had made for this year to Her Majesty's commissioners for the Exhibition, including a passage-way across the gardens: the society would receive in return the sum of 1000*l*.—Scientific committee—Prof. Westwood, F.L.S., in the chair. The Rev. M. J. Berkeley commented on an article in the recent number of the journal of the Royal Agricultural Society on the injury suffered by horses fed upon mouldy oats. There was an evident error with respect to the fungus figured as *Aspergillum* (sic) which was clearly the common bread-mould *Ascophora Mucedo*. With respect to the diseased coffee-plants from Natal brought forward at the last meeting he was disposed to think that climatic conditions were the cause, of their malady. The differences between the summer and winter temperatures had been too slight to check the growth of the coffee trees. There are often three flowerings instead of one, or at all events two. It seemed on the whole probable that growth was over-estimated, and that, consequently, when the drought came, the plants were unable to support it. There was a minute immature black fungus, which might be referred to *Depazea*, on the twigs. Prof. Thiselton Dyer read a letter addressed to Dr. Hooker from Dr. Henderson in charge of the Calcutta Botanic Garden, describing the disease of the opium poppy. This appeared to be favoured by moist weather, and the plants affected were infested with *Peronospora arborescens*, and also with a fungus (which Mr. Berkeley identified as *Macrosporium cheiranthi*, a peculiar form of *Cladosporium herbarum*.) The places attacked were black, and the disease progressed from below, upwards. If the plant has not flowered when attacked, it never does so; but if it is on the point of flowering, the sepals, petals, and stamens, do not drop off as they would do in healthy plants. The effect of guano, even in very small quantities, was remarkable in increasing the crop.

Institution of Civil Engineers, April 29.—Mr. T. Hawksley, president, in the chair.—"On the Rigi Railway," by Dr. William Pole, F.R.S., M. Inst. C.E. The object of this railway was to convey passengers to the top of the Rigi, a mountain near Lucerne, from which there was a view so celebrated as to attract large numbers of visitors in the summer months. The line commenced at Vitznau, on the Lake of Lucerne, and was about four miles long. The works are mostly formed by cutting and benching on the rocky slope of the mountain. There was but one short tunnel, and only one iron bridge over a ravine. The gauge was 4 feet 8½ inches.

GLASGOW

Geological Society, April 10.—Mr. John Young, vice-president, in the chair.—The chairman exhibited a specimen

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of carboniferous limestone from Braidwood, near Carluke, containing in great abundance the tests or shells of a species of Foraminifer, *Saccimina carteri.* Similar organisms had been found in a limestone from the Elf Hills, Northumberland, and described by Dr. H. B. Brady in 1871. They had also been found once or twice in the limestones of the east of Scotland, but so far as he was aware, this was the first instance in which it had been recognised in the limestones of the Lanarkshire coal field.—Mr. J. Thompson, F.G.S., read a paper which he had prepared in conjunction with Mr. Henry Caunter, on the geology of the neighbourhood of Stornoway, island of Lewis. The authors briefly described the relations of the gneissic or Laurentian rocks to the Cambrian strata of the island. The junction of the two formations is seen in the bed of a small stream that flows into the sea in the harbour of Stornoway; also in Garabost Bay, about seven miles to the east. The Laurentians dip N.W., while the lower members of the Cambrian dip at an angle of 23° to the N.E. These beds have been termed by Sir R. Murchison, Upper Cambrian. The authors next described the more recent deposits of the island, beginning with the boulder drift, with its transported striated erratics, all of which belong to the Laurentian system, and are traceable to the west and north-west. They then referred to the gravels and drift-sand which overlie the remains of an extensive bed of peat seen in Stornoway Bay, where it attains a depth of 15 feet. At the lower extremity of this bed, and only seen at extreme low tides, are numerous stumps of trees of considerable dimensions, the roots of which rest upon and pass down through a bed of clay which forms the subsoil. From this it would seem that there has been an extensive subsidence of the island at a comparatively recent period, and that the climatal conditions must have been very different during the time when such trees grew from those which prevail at the present day.

PARIS

Academy of Sciences, April 28.—M. de Quatrefages, president, in the chair.—The following papers were read.—On the actions produced in capillary spaces by molecular attractions, by M. Becquerel. The author described the various results produced by inserting solutions contained in cracked vessels into other vessels containing solutions capable of producing precipitates in them, *e.g.* baric nitrate and potassic sulphate. After a few days the solutions communicate by the crack and electric currents are started.—On the heat disengaged by the reactions between the alkalis and water: potassic and sodic hydrates by M. Berthelot. The results obtained lead the author to suppose that there is a potassic hydrate intermediate between the ordinary fused and crystallised hydrates.—On the combinations produced by the electric discharge between marsh gas and carbonic anhydride, and between carbonic oxide and hydrogen, by MM. P. and A. Thenard.—On certain particular spectroscopic observations by Father A. Secchi.—On the application of the pandynamometer to the measurement of the work performed by a steam engine, by M. G. A. Hirn.—On the application of the mathematical theory of elasticity to the study of articulated systems formed by elastic rods, by M. Maurice Levy.—On the composition of the thermic mineral waters of Vichy, Bourbon l'Archambault, and Neris, as regards those substances which invariably exist in water in minute proportions, by M. de Gouvernain.—An examination of the difference produced in the spectrum of chlorophyll by different solvents, by M. J. Chautard.—On the unwholesome nature of the Versailles water supply, by M. E. Decaisne.—On the awakening of the Phylloxera in the month of April 1873, by M. Faucon.—On nebulæ discovered and observed at the Marseilles observatory, by M. E. Stephan.—On characteristics in the theory of conics, on planes, and in space, and on second order surfaces, by M. Halphen.—On the vapour emitted at the same temperature by the same body in two states, by M. J. Moutier.—On the spectrum of erbia, by M. Lecocq de Boisbaudran. The author has found that erbia and erbic phosphate give, when heated, different band spectra, of which the author exhibited plates and tables. These spectra he has carefully investigated, and finding it impossible to attribute either of them to another body, he concluded that they were both due to erbium in different states of combination.—Observations on M. du Moncel's late note on the history of the silent discharge, by M. Arn. Thenard.—On the Manufacture of ammonic sulphate from nitrogenous waste products, by M. L'Hote.—On the conditions of formation of extra silicious pig in blast furnaces, by M. S. Jordan. Experiments on the effects of dynamite, by MM. Roux and Jarrou.—On necrobiosis and gangrene, an experimental study on the phenomena of mortification and putrefaction as they occur in the living body, by M. Chauveau.—On the geology of Mount Léberon, by M. A. Gaudry.

DIARY

THURSDAY, May 8.

Royal Society, at 8.30.—Contributions to the Study of the Errant Annelides of the older Palæozoic Rocks: Prof. Alleyne Nicholson.—Researches in Spectrum Analysis in Connection with the Spectrum of the Sun: J. Norman Lockyer.—The Action of Light on the Electrical Resistance of Selenium: Lieut. Sale.

Mathematical Society, at 8.—On Bicursal Curves, and Plan of a Curve-tracing Apparatus: Prof. Cayley.—On an application of the Theory of Unicursal Curves: M. Hermite.

Society of Antiquaries, at 8.30.

Royal Institution, at 3.—Light: Prof. Tyndall.

FRIDAY, May 9.

Royal Institution, at 3.—A Fortnight in Asia Minor: Mr. Grant Duff, M.P.

Astronomical Society, at 8.

Quekett Club, at 8.

SATURDAY, May 10.

Royal Institution, at 3.—Ozone: Prof. Odling.

MONDAY, May 12.

Royal Geographical Society, at 8 30.

London Institution, at 4.—Elementary Botany: Prof. Bentley.

TUESDAY, May 13.

Royal Institution, at 3.—Roman History and Architecture: J. H. Parker.

Photographic Society, at 8.—On instantaneous Landscape Photography: F. R. Elwell.—Improvements in Carbon Printing: A. Marion.

WEDNESDAY, May 14.

Society of Arts, at 8.—Improvements in Rifles: Capt. O'Hea.

Geological Society, at 8.—Notes on Structure in the Chalk of the Yorkshire Wolds: J. R. Mortimer.—On the genus *Palæocoryne*, Duncan and Jenkins, and its affinities: Prof. P. Martin Duncan.—On *Platysiagum sclerocephalum* and *Palæospinax priscus*, Egerton: Sir Philip de M. Grey-Egerton.—On a new genus of Silurian Asteridæ: Dr. Thomas Wright.

Archæological Association, at 8.—Anniversary.

London Institution, at 7.—Paper and Discussion.

Society of Telegraph Engineers, at 7.30.—On the Block System of Working Railways: W. H. Preece and Capt. Mallock.

THURSDAY, May 15.

Royal Society, at 8.30.

Society of Antiquaries, at 8.30.

Chemical Society, at 8.—On Isomerism: Dr. H. E. Armstrong.

Numismatic Society, at 7.

Royal Institution, at 3.—Light: Prof. Tyndall.

BOOKS RECEIVED

English.—Comet's Tails no longer a Mystery: T. A. R. (Reeves and Son).—Manual for Medical Officers of Health: E. Smith (Knight & Co.).—Manchester Science Lectures, 1871–73. 3rd Series: J. Heywood & Co.—Tropical World. New Edition: Dr. G. Hartwig (Longmans).—The Life of von Humboldt, Vols. i. and ii.: Bruhns, translated by Lassell (Longmans).—Astronomical Plates from the Observatory of Harvard College (Trübner).—Text-books of Science; Electricity, and Magnetism: F. Jenkin (Longmans).—Critiques and Addresses: Thomas Huxley (Macmillan & Co.)—The Familiar History of British Fishes: Frank Buckland (published by the Society for promoting Christian Knowledge).—The Cruise of the *Curacoa* among the South Sea Islands, 1865: J. C. Brenchley (Longmans).

Foreign.—Zeitschrift fur Biologie, Part 1, Vol. ix.—Zoologische Botanische Gesellschaft in Wien, Vol. xxii., 1872.—Die Naturkräfte, Munich. Edited by Dr. K. A. Zittel.

CONTENTS

Page

A Voice from Cambridge 21
Coues' American Birds 22
Flammarion's Atmosphere. By W. F. Barrett, F.C.S. (*With Illustrations*) 22
Our Book Shelf 24
Letters to the Editor:—
  Originators of Glacial Theories.—A. Agassiz 24
  Scientific Endowments and Bequests.—F. M. Balfour 25
  Permanent and Temporary Variation of Colour in Fish.—W. Saville Kent 25
  On Approach caused by Velocity and Resulting in Vibration.—Hermann Smith 25
  The Hegelian Calculus.—J. Hutchison Stirling 26
  Moving in a Circle 27
Justus Liebig. By Prof. H. E. Roscoe, F.R.S. 27
Notes from the *Challenger* (*With Illustrations*). By Prof. Wyville Thomson, F.R.S. 28
On the Origin and Metamorphoses of Insects, III. By Sir John Lubbock, Bart., M.P., F.R.S. (*With Illustrations.*) 31
Notes 34
On the Hypotheses which lie at the Bases of Geometry, II. By Bernhard Riemann. Translated by Prof. W. K. Clifford 36
The Theory of Evolution in Germany, III. 38
Scientific Serials 38
Societies and Academies 39
Books Received 40
Diary 40

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